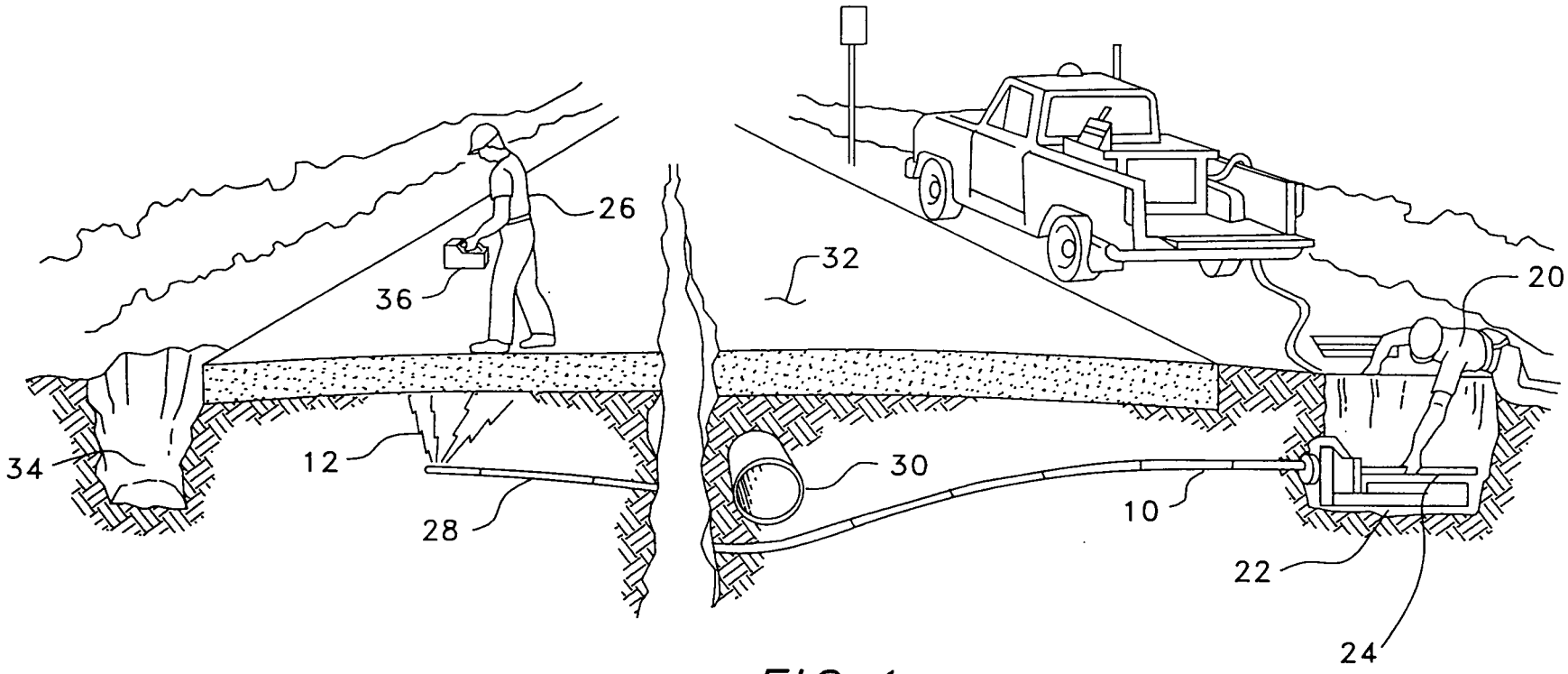


FIG. 1
(PRIOR ART)

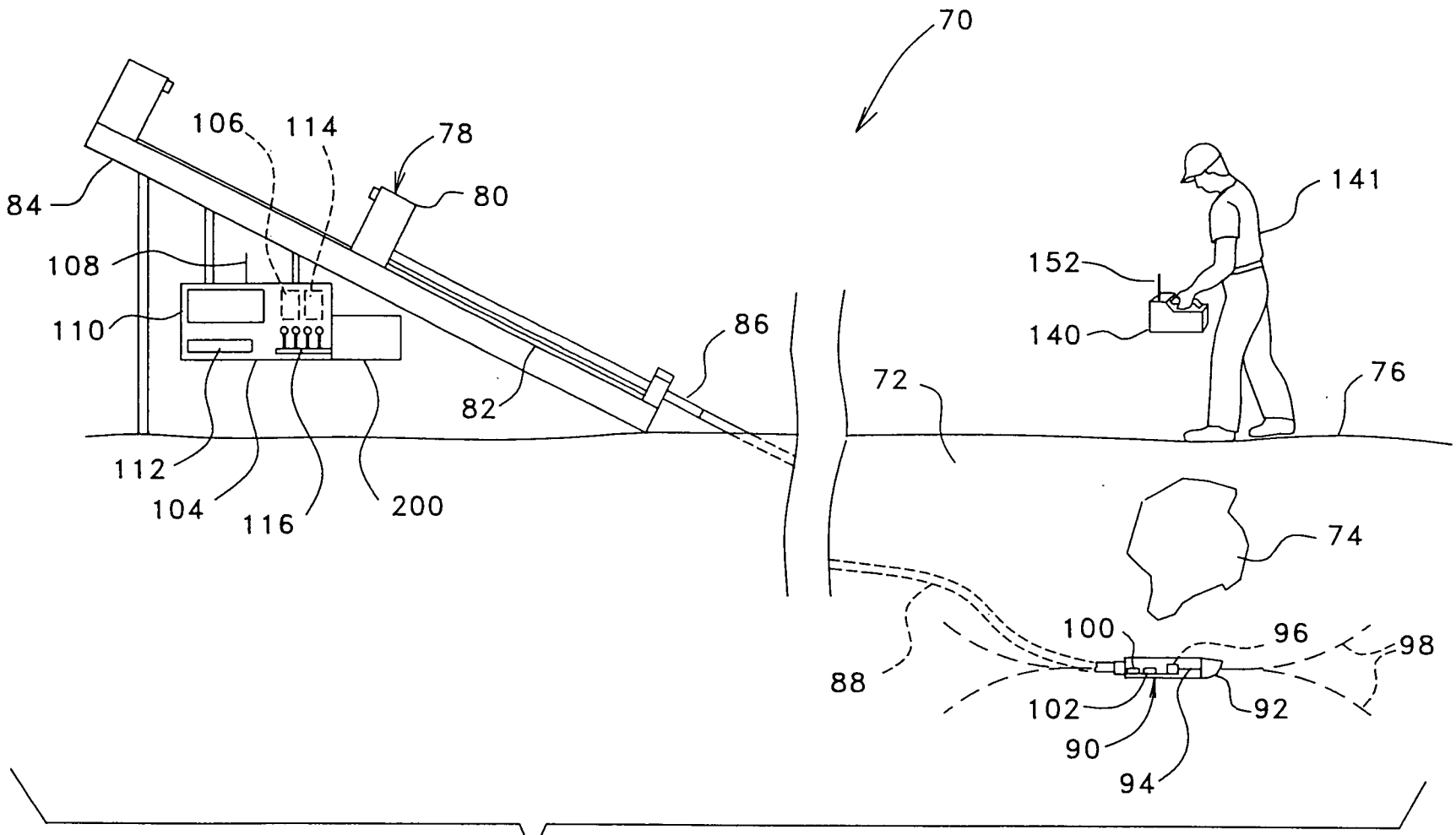
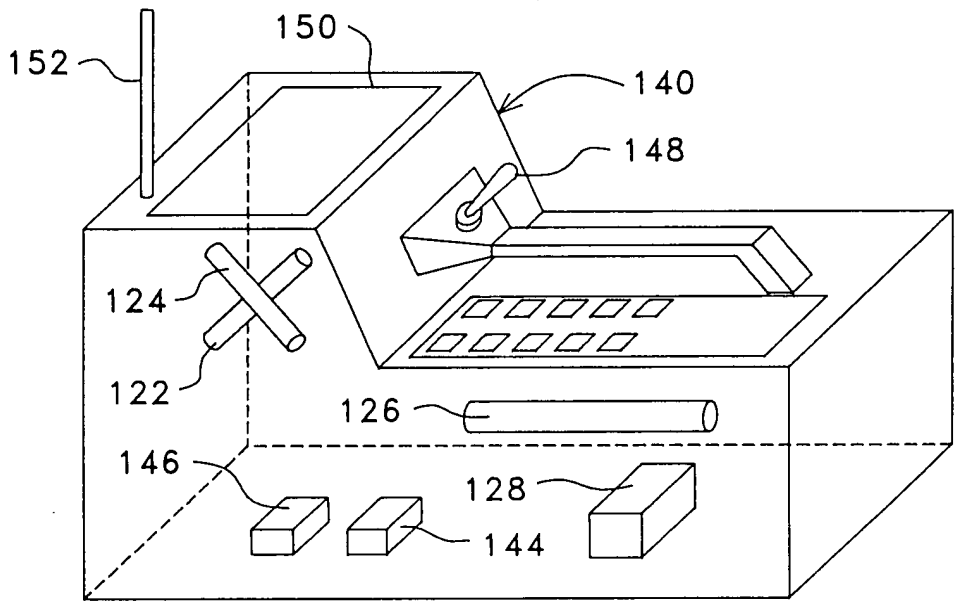

70
106
114
78
80
84
108
110
86
82
72
141
152
140
76
112
104
116
200
74
100
96
98
88
102
92
90
94

FIG. 2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140
148
124
122
126
146
128
144

FIG. 3

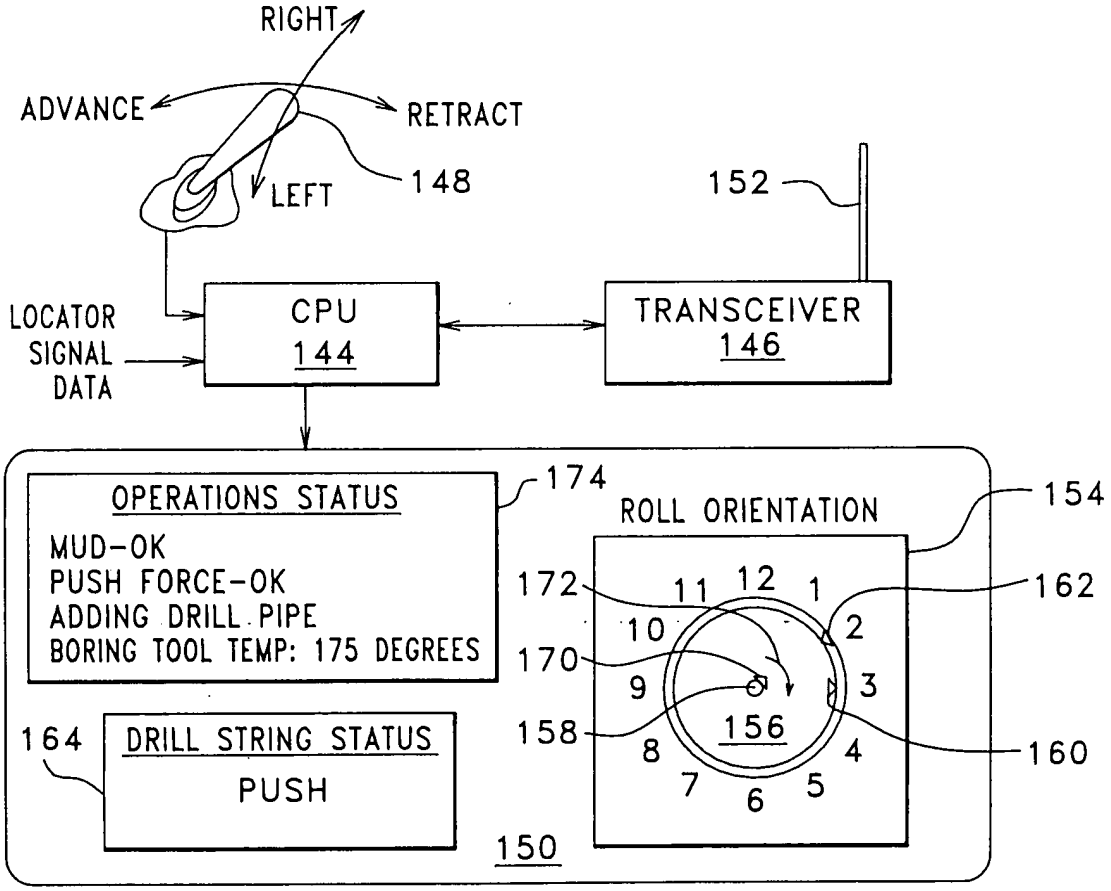
RIGHT
ADVANCE
RETRACT
LEFT
148
152
LOCATOR
SIGNAL
DATA
CPU
144
TRANSCEIVER
146
OPERATIONS STATUS
MUD-OK
PUSH FORCE-OK
ADDING DRILL PIPE
BORING TOOL TEMP: 175 DEGREES
174
ROLL ORIENTATION
154
172
162
170
158
160
156
164
DRILL STRING STATUS
PUSH
150

FIG. 4

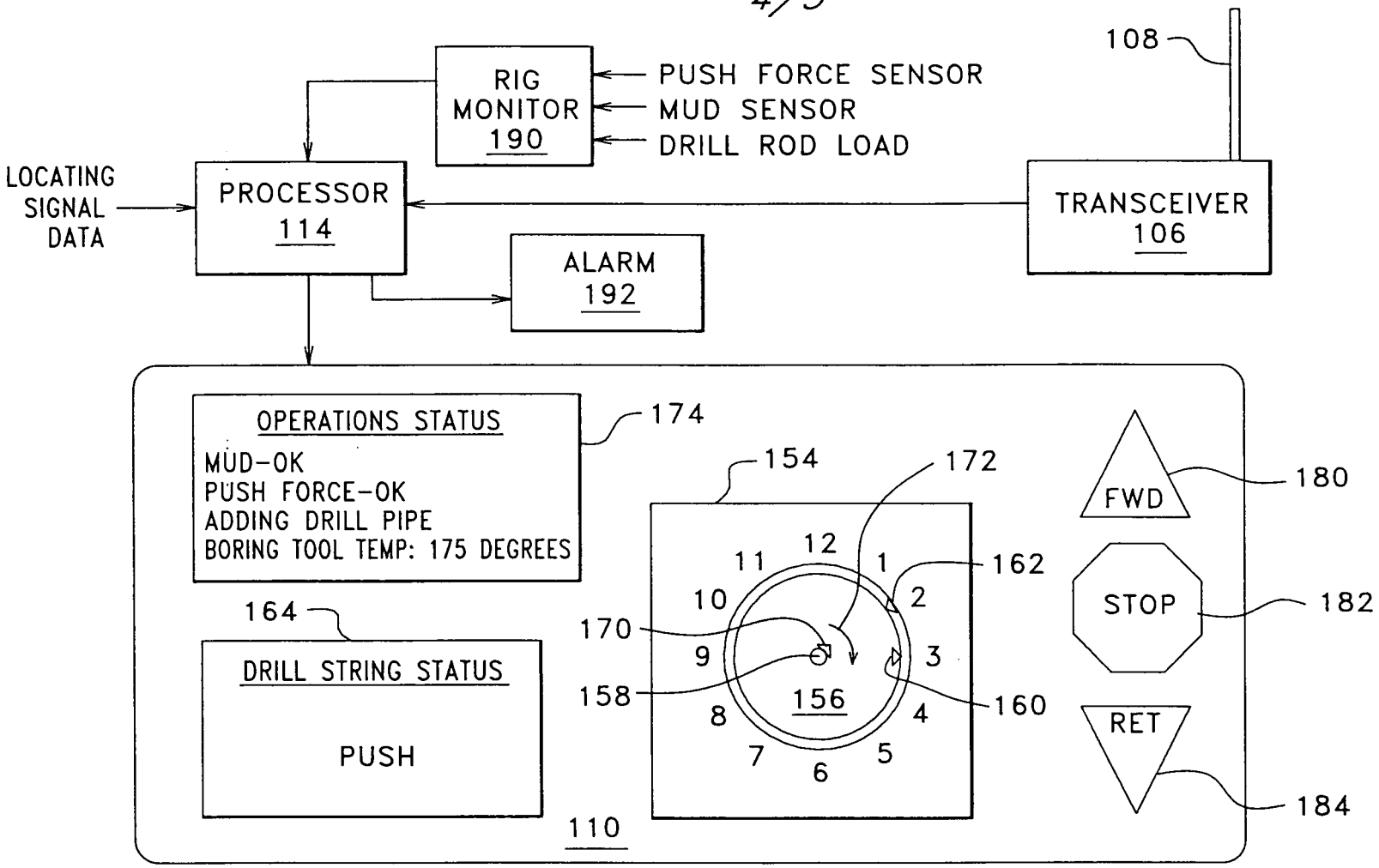
RIG MONITOR 190
PUSH FORCE SENSOR
MUD SENSOR
DRILL ROD LOAD
108
LOCATING SIGNAL DATA
PROCESSOR 114
TRANSCEIVER 106
ALARM 192
OPERATIONS STATUS
MUD-OK
PUSH FORCE-OK
ADDING DRILL PIPE
BORING TOOL TEMP: 175 DEGREES
174
154
172
180
FWD
162
STOP
182
164
DRILL STRING STATUS
PUSH
170
158
156
160
RET
184
110

FIG. 5

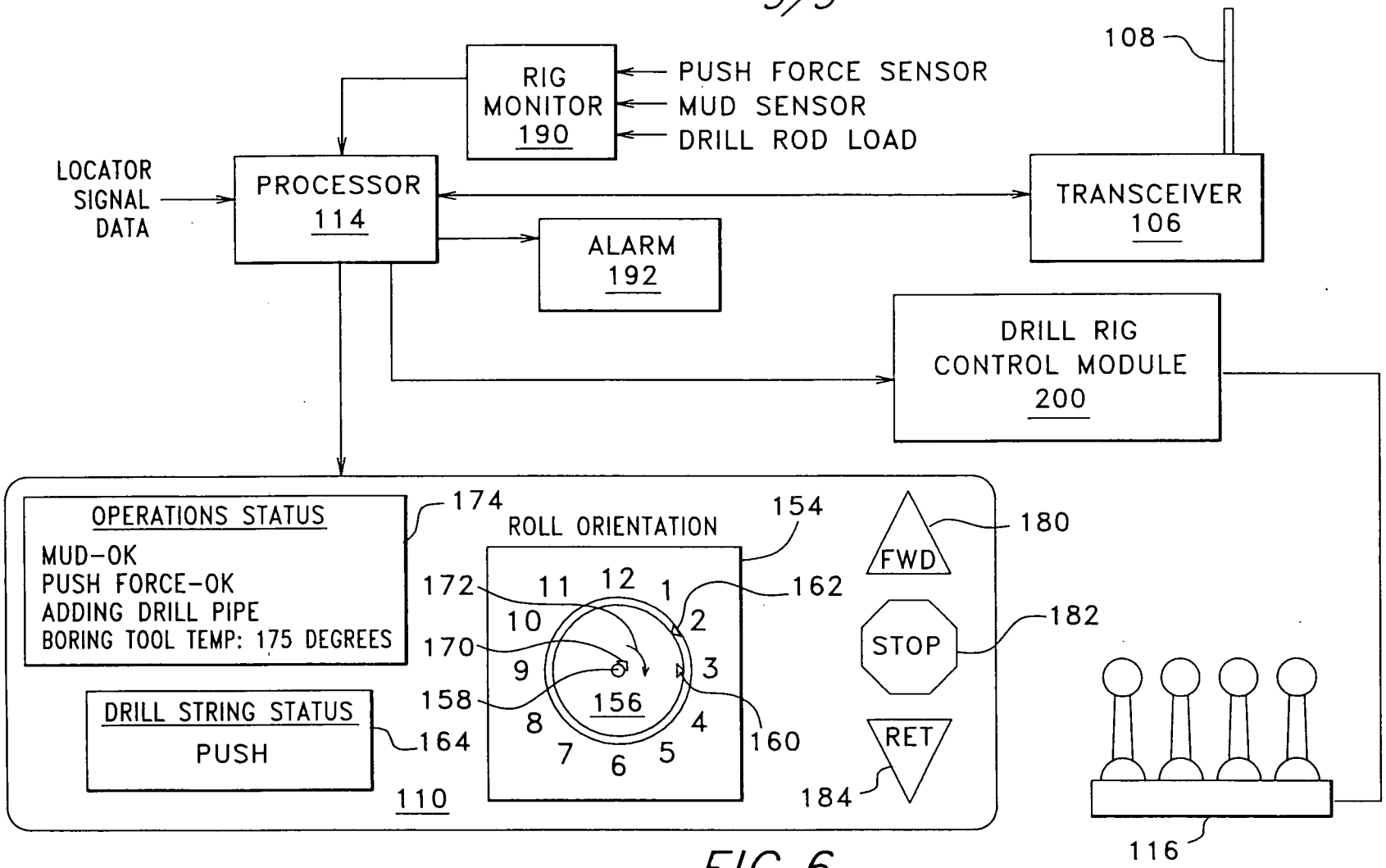
RIG MONITOR 190
PUSH FORCE SENSOR
MUD SENSOR
DRILL ROD LOAD
108
LOCATOR SIGNAL DATA
PROCESSOR 114
TRANSCEIVER 106
ALARM 192
DRILL RIG CONTROL MODULE 200
OPERATIONS STATUS
MUD-OK
PUSH FORCE-OK
ADDING DRILL PIPE
BORING TOOL TEMP: 175 DEGREES
174
ROLL ORIENTATION
154
172
162
170
158
156
160
DRILL STRING STATUS
PUSH
164
110
FWD
180
STOP
182
RET
184
116

FIG. 6